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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/736,859 | 12/16/2003 | Jie Yao | 78227CIP1 P1510USCIP | 5386 |

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EXAMINER

LEE, EUGENE

ART UNIT PAPER NUMBER

2815

DATE MAILED: 12/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|--------------------------------------|---------------------------------|--|
| Office Action Summary | Application No. 10/736,859 | Applicant(s) YAO, JIE | |
| | Examiner Eugene Lee | Art Unit 2815 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 October 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 6-9 and 11-18 is/are pending in the application.
- 4a) Of the above claim(s) 14 and 15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6-9, 11-13, 16-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- 1. ☐ Certified copies of the priority documents have been received.
 - 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claims 8, 9, and 13 are objected to because of the following informalities: in line 2 of said claims, the word "of" is missing; in claim 13, comma punctuations are missing between "an anode a cathode and an intrinsic layer". Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 6 thru 9, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Goossen et al. 4,904, 859. Goossen discloses (see, for example, FIG. 1) a semiconductor device (photodiode) 110 comprising an intrinsic layer (semiconductor intrinsic light absorption layer) i, p-type region (p-doped light absorption layer) 111, n-type contact region (n-doped light absorption layer) 112, and contact pads (cathode electrode and anode electrode) 116, 117. In column 4, lines 35-39, Goossen discloses the p-type contact region having a thickness of 7000 Å; in column 4, lines 14-22, Goossen discloses the layers of the n-type contact region collectively being greater than 1000 Å + 1000 Å; and in column 4, lines 25-29, column 4, lines 23-25, and column 4, line 35, Goossen discloses the intrinsic layer comprising a quantum well region 114 being 500 Å, GaAs spacer layer 115 being 500 Å, and intrinsic spacer layer 113 being 500 Å respectively. These thicknesses clearly discloses the relationship wherein $(t_p + t_n) / t_i$ is greater or

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equal to 0.17 since the thickness of the p-type region is already many times greater than the intrinsic layer.

Regarding the limitation “a doping concentration of d_c between $1e17$ and $2e18 \text{ cm}^{-3}$ ”, see, for example, column 4, lines 39, wherein Goossen discloses the p-type region having a concentration of $10^{18} \text{ atoms/cm}^3$, and column 4, lines 18, wherein Goossen discloses the n-type region having a concentration of $10^{18} \text{ atoms/cm}^3$.

Regarding the limitation “intrinsic layer has doping below $5e14 \text{ cm}^{-3}$ ”, see, for example, column 4, lines 25-26, wherein Goossen discloses the quantum well region as undoped (doping below $5e14 \text{ cm}^{-3}$).

Regarding claim 13, the limitation “wherein the presence of the p-doped or n-doped absorption layer increases by 20% or more the responsivity x bandwidth product over a p-i-n consisting of an anode, a cathode, and an intrinsic layer” is inherent in Goossen’s invention since Goossen discloses the thickness $(t_p+t_n) / t_i$ being greater or equal to 0.17 (as disclosed in claim 6).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 11, 12, and 16 thru 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goosen et al. ‘859 as applied to claims 6-9, and 13 above, and further in view of Jang et al. “P-I-N Photodiodes in Metamorphic InAlAs/InGaAs/GaAs for Long Wavelength Applications”.

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Goosen does not disclose the doped and intrinsic absorption layers being InGaAs lattice-matched to InP. However, Jang discloses (see, for example, first paragraph) photodetectors typically having InGaAs lattice matched to InP. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have the doped and intrinsic absorption layers being InGaAs lattice-matched to InP in order to operate at long wavelengths, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Regarding claims 11, and 12, Goosen in view of Jang does not disclose the limitation “the total thickness of the doped and intrinsic light absorption layers is greater than $v/(2f_3 - db)$ by 20% or more, where v is the saturation drift velocity of either the electron or the hole, whichever is smaller, in the intrinsic light-absorbing layer”. However, the total thickness of the doped and intrinsic light absorption layers are result effective variables that one of ordinary skill in the art would optimize for emitting light. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the total thickness of the doped and intrinsic light absorption layers is greater than $v/(2f_3 - db)$ by 20% or more, where v is the saturation drift velocity of either the electron or the hole, whichever is smaller, in the intrinsic light-absorbing layer, in order to maximize the amount of light emitted since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

Response to Arguments

6. Applicant's arguments with respect to claims 6-9, 11-13, and 16-18 have been considered but are moot in view of the new ground(s) of rejection.

Regarding the applicant's argument that Goosen does not disclose a semiconductor photodiode that has P-I-N layers, this argument is not persuasive. Clearly, Goosen discloses (see, for example, FIG. 1) a semiconductor device that has P-I-N layers made of semiconductor. Light enter as a beam 104 into layer 111, and emerges as light 105 out of layer 105. Clearly, semiconductor layer 104 admits the light so that the light may emerge through layer 105. In addition, the P-I-N structure of Goosen is identical to the P-I-N structure of the applicant's invention that such functional language such as "photodiode", and "absorption" is disclosed by Goossen. The Encyclopedia Online discloses <http://www.search.eb.com/eb/article-34329>

Two-terminal junction devices > The *p-i-n* diode**The *p-i-n* diode**

A *p-i-n* diode is a *p-n* junction with an impurity profile tailored so that an intrinsic layer, the "*i* region," is sandwiched between a *p* layer and an *n* layer. The *p-i-n* diode has found wide application in microwave circuits. It can be used as a microwave switch with essentially constant depletion-layer capacitance (equal to that of a parallel-plate capacitor having a distance between the plates equal to the *i*-region thickness) and high power-handling capability.

Such a definition clearly fits the semiconductor device disclosed in FIG. 1 of Goossen and the light 104 disclosed in FIG.1 makes the *p-i-n* diode a photodiode.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

INFORMATION ON HOW TO CONTACT THE USPTO

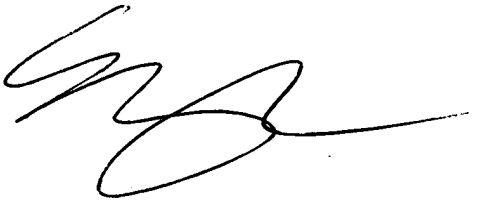
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 571-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eugene Lee
December 16, 2005



SPE Kenneth R. Pak
TL 2800